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DESCRIPTION OF A NEW SPECIES OF *ECHIODON* (TELEOSTEI: CARAPIDAE) FROM ANTARCTIC AND ADJACENT SEAS

Douglas F. Markle, Jeffrey T. Williams, and John E. Olney

Abstract.—*Echiodon cryomargarites,* a previously unrecognized species of carapid fish, is described from adult and larval specimens collected in relatively deep water from the Antarctic and adjacent seas. This species differs from *E. exsilium* and *E. dawsoni,* which have fewer precaudal vertebrae, and from *E. dentatus* and *E. drummondii* which have slightly higher D_{30} counts, fewer pectoral rays, and fewer vertebrae to the origin of the dorsal fin. The new species has a relatively deep, flaccid body and was collected over bottom depths ranging from 400–1200 m off Argentina, South Georgia Island, and New Zealand. Two other specimens that differ slightly in geographic and depth distribution, appearance, and have a shallow, firm body were caught at depths of 1500–1666 m off southern Chile.

The distal tips of the transverse processes of the first two vertebrae in *E. cryomargarites* are ligamentously attached to paired sclerified structures of the anterior swimbladder. This condition may represent a precursor to the rocker bone specialization of *Onuxodon.*

During independent investigations of the pearlfish genus *Echiodon* (Olney and Markle 1979; Williams and Shipp 1982), a previously undescribed species was encountered in samples from southern oceans. The species was apparently mentioned by Andriashev (1977) and a larva now assigned to this species was collected by Dr. Thor Mortensen from Campbell Island shepherds (Rendahl 1926).

In this report we examined 26 adults and five larvae of this deep-dwelling, southern ocean *Echiodon.* Our purpose is to document their distribution and describe the new species we recognize. *Echiodon,* as recognized herein, is defined by an eclectic group of characters taken from Arnold (1956), Cohen and Nielsen (1978), Robertson (1975), Maul (1976), Olney and Markle (1979) and Williams and Shipp (1982). For the purposes of this paper, the genus is diagnosed as those carapids[1] with 15–25 pectoral fin rays, 20–29 precaudal vertebrae, a free maxillary, enlarged canines at jaw symphyses, an anus posterior to a vertical through the pectoral fin base, no median rocker bone at anterior end of swimbladder, and larvae in which the first dorsal ray inserts immediately posterior to the vexillum and the vexillum origin is posterior to a vertical through the first anal ray. Hypotheses on phylogenetic relationships within *Echiodon* are beyond the scope of this paper, but such studies are in progress.

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[1] We have been informed by G. S. Myers through G. C. Steyskal that the stem of the family name is *Carap*—rather than *Carapod*—(Steyskal 1980) since the derivation is from a native Brazilian word, çarapo, and not the Greek, pous. Thus, the family is Carapidae not Carapodidae.

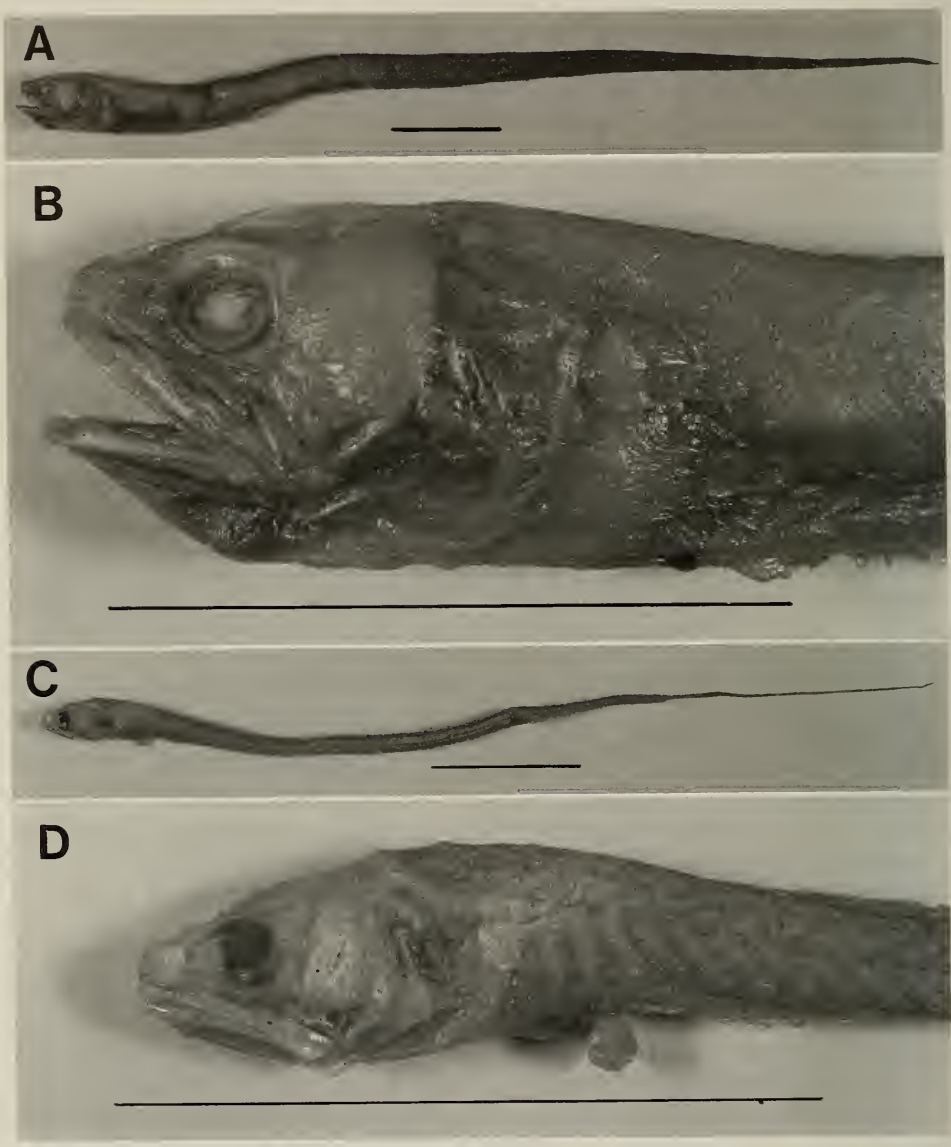

Fig. 1. *Echiodon cryomargarites,* holotype, LACM 10985-6. A, Left lateral view; B, View of head; *Echiodon* specimen, LACM 42593-2. C, Left lateral view; D, View of head.

Methods and Materials

Counts and measurements of adults follow Williams and Shipp (1982), and of larvae follow Olney and Markle (1979). Abbreviations D_{30} and A_{30} refer to the dorsal and anal rays whose bases lie anterior to vertebra 31.

Cephalic lateralis pore series terminology used in this paper follows Williams and Shipp (1982) except as follows. The lateral series (LT) is restricted to include those large pores of the lateral-temporal canal between that canal's junctions with

Table 1.—Summary of selected measurements for adult *E. cryomargarites* and *E.* specimens. Values for holotype listed in parentheses. All measurements given as percent of head length.

	E. cryomargarites	*E.* specimens
Snout length	19–27 (20)	18–21
Orbit diameter	23–29 (23)	24–25
Iris diameter	18–24 (20)	18–19
Upper jaw length	54–66 (56)	56–58
Lower jaw length	55–59 (55)	54–56
Predorsal length	160–200 (180)	180–190
Preanal length	120–150 (130)	120–130

the preopercular (POP) and the infraorbital (IO) canals. The supratemporal series (ST) includes those large pores on both sides of the head that are dorsad of the junctions of the supratemporal canal with the lateral temporal canals. Pores were located by directing a jet of air through the canals.

Gosline (1960) pointed out that there is confusion about the definition of ophidiiform "ribs," since some of the anterior transverse processes articulate basally with their respective vertebral centra ("sessile ribs" of Regan 1912), while posterior transverse processes fuse basally to their centra. Since pyramodontines have pleural ribs at the ventral ends of elongate transverse processes, we prefer to avoid the term "ribs." The term transverse process used herein follows Gosline (1960) and is equivalent to the "sessile ribs" and transverse processes of Regan (1912) and the "ribs" of Courtenay and McKittrick (1970).

Cranial vault length refers to the greatest anterior to posterior distance in a sagittal plane within the braincase as determined from radiographs and cleared and stained specimens.

Material examined is listed under individual species accounts. Museum acronyms used are LACM—Los Angeles County Museum, Los Angeles, California; ISH—Institut für Seefischerei, Zoological Museum, University of Hamburg, Hamburg, West Germany; ZMUC—Zoological Museum, University of Copenhagen, Copenhagen; and USNM—National Museum of Natural History, Smithsonian Institution, Washington, D.C. Other abbrevaitions used are TL—total length, SL—standard length, IKMT—Isaacs–Kidd Midwater Trawl, SO—supraorbital series, IO—infraorbital series, LT—lateral series, ST—supratemporal series, POP—preopercular series, and MD—mandibular series.

Echiodon cryomargarites, new species
Figs. 1A and B

Holotype.—LACM 10985-6, 410 mm TL, 37.3 mm HL, male; "*Eltanin*" sta 1422, 56°19′–21′S, 158°29′E, 12 Feb 1965, 3 m (10 ft) Blake trawl, 833–842 m bottom depth range.

Paratypes.—Off New Zealand: LACM 10985-8, 3 specimens, 230–310 mm TL, 21.8–27.3 mm HL, males; caught with holotype. LACM 10985-7, damaged; caught with holotype. LACM 10979-4, ca. 220 mm TL, ca. 16 mm HL, female; "*Eltanin*" sta 1414, 52°17′–22′S, 160°40′–34′E, 9 Feb 1965, 3 m Blake trawl, 659–798 m.

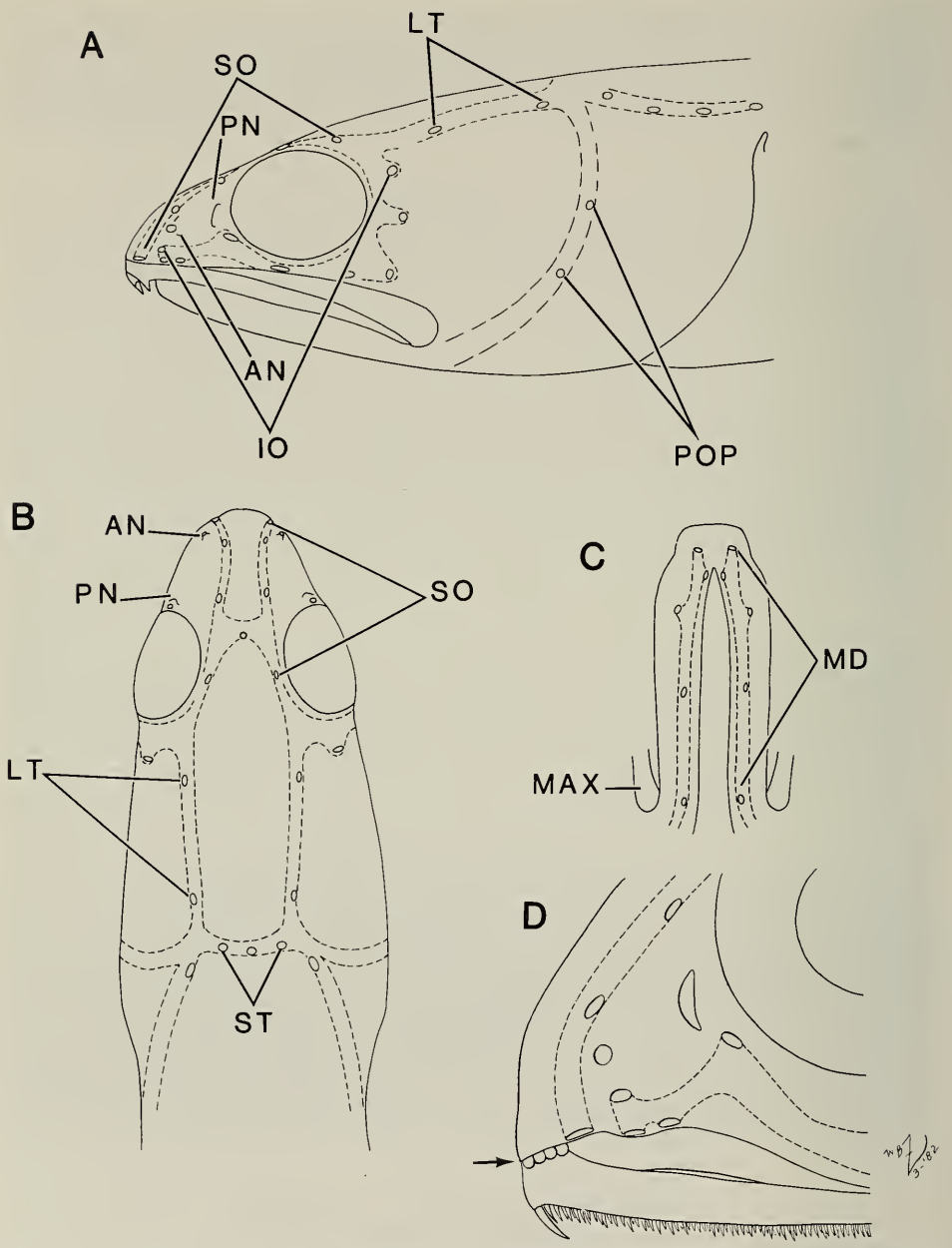

Fig. 2. *Echiodon cryomargarites,* LACM 10985-6, diagrammatic illustration of cephalic lateralis pores and upper lip lobes. A, left lateral view; B, Dorsal view; C, Ventral view of lower jaw; D, Magnified snout region showing lobes under upper lip. Prepared by W. Zomlefer.

LACM 10984-3, three specimens, ca. 210 mm TL (female), ca. 220 mm TL (female), 255 mm TL (male), 16.0–22.7 mm HL; "*Eltanin*" sta 1419, 54°32′–31′S, 159°02′–01′E, 10 Feb 1965, 3 m Blake trawl, 494–714 m.

Off Argentina and Brazil: ISH 317/71, 280 mm TL, 20.5 mm HL, female;

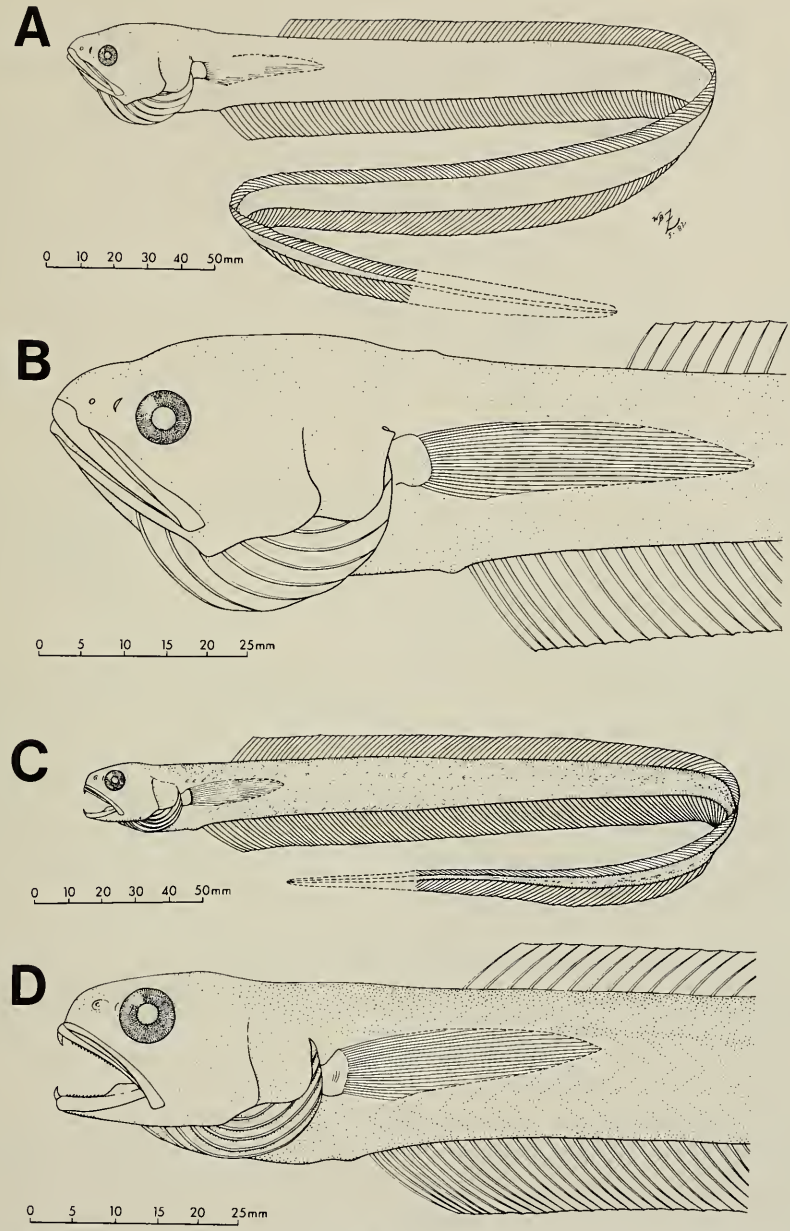

Fig. 3. *Echiodon cryomargarites,* A, B. Drawings of male holotype, LACM 10985-6, from off New Zealand. C, D. Drawings of female paratype ISH 300/71 from off Falkland Islands. Prepared by W. Zomlefer.

"*Walther Herwig*" sta 312/71, 46°53′S, 60°00′W, 18 Feb 1971, bottom trawl, 800 m. ISH 1108/66, four specimens, 181–243 mm TL, 12.3–17.0 mm HL, females; "*Walther Herwig*" sta 230/66, 35°04′S, 52°15′W, 12 Jun 1966, bottom trawl, 600 m. ISH 1554/66, 113+ mm TL, 12.3 mm HL, male; "*Walther Herwig*" sta 428/

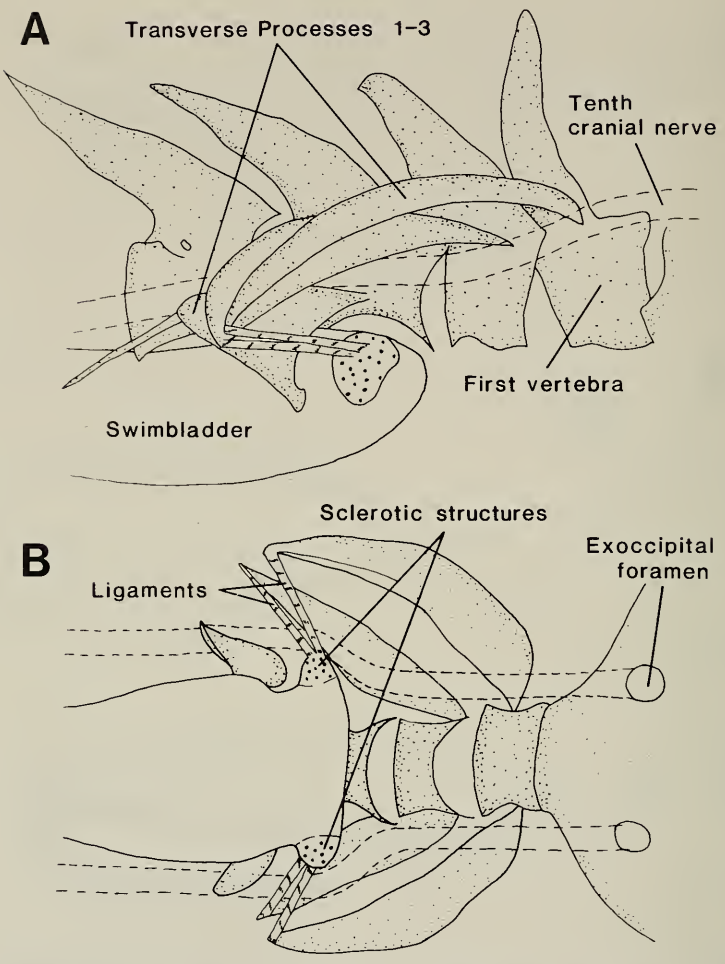

Fig. 4. *Echiodon cryomargarites,* LACM 10984-3. A, Right lateral view of first four centra illustrating modified transverse processes of first three centra, position of tenth cranial nerve, and swimbladder modifications; B, Ventral view of A.

66, 34°48′S, 52°02′W, 28 Jul 1966, bottom trawl, 400 m. ISH 1229/66, 209 mm TL, 12.0 mm HL, female; "*Walther Herwig*" sta 268/66, 39°56′S, 55°58′W, 19 Jun 1966, bottom trawl, 600 m. ISH 1580/66, three specimens, 188–245 mm TL, 12.7–20.0 mm HL, females; "*Walther Herwig*" sta 438/66, 33°41′S, 51°12′W, 31 Jul 1966, bottom trawl, 600 m. ISH 1818/68, two specimens, 268–302 mm TL, 22.3–23.3 mm HL, males; "*Walther Herwig*" sta 65/68, 29°57′S, 47°35′W, 27 Feb 1968, bottom trawl, 1200 m. Off South Georgia Is.: ISH 334/76, 255 mm TL, 19.8 mm HL, male; "*Walther Herwig*" sta 33/76, 53°36′S, 35°40′W, 11 Dec 1976, bottom trawl, 800 m.

Off Falkland Is.: ISH 300/71, two specimens, 310–315 mm TL, 25.7–27.8 mm HL, females; "*Walther Herwig*" sta 241/71, 55°00′S, 57°50′W, 4 Feb 1971, bottom trawl fished in midwater above a bottom of 775–850 m.

Diagnosis.—A species of *Echiodon* from southern oceans with a relatively flac-

Table 2.—Selected measurements and counts of *E. cryomargarites* larvae. All measurements as percent head length.

	ZMUC Dana 3641 I	USNM 257747	LACM 42592-1	LACM 11505	ZMUC P7710
Head length	4.6 mm	4.4 mm	7.9 mm	3.6 mm	7.0 mm
Snout length	26	23	20	—	28
Eye diameter	22	27	22	—	24
Upper jaw length	44	—	51	—	—
Lower jaw length	56	55	58	64	57
Vexillum length	236	218	311	492	—
Snout to vexillum	196	198	233	227	220
Snout to dorsal	203	207	247	238	236
Snout to anal	169	171	184	151	156
Snout to anus	155	155	186	153	200
A_{30}	45	45	48	45	—
D_{30}	39	40	36	34	—
Vertebrae to vexillum	10	10	12	13	11
Vertebrae to dorsal	11	11	13	14	12
Vertebrae to anal	8	8	9	8	8
Precaudal vertebrae	—	27	—	—	—

cid body, caught over depth range 400–1200 m, D_{30} 36–40, two pores in POP canal.

Description.—Morphometric data are summarized in Table 1. Meristic data are as follows, holotype in parentheses: D_{30} 36–40 (38), A_{30} 46–50 (47), pectoral fin rays on left side 19–21 (21), anal fin origin under vertebrae 6–8 (6), dorsal fin origin over vertebrae 11–12 (11), precaudal vertebrae 25–29 (28), developed gill rakers 3, olfactory rosette with seven pairs of lamellae (clear and virtually uncountable in holotype and paratypes of LACM 10985), pores of cephalic lateralis system: SO-5, IO-9, LT-2, ST-3, POP-2, MD-5 (generally difficult to see), upper lip bears three or four small lobes (Fig. 2). Sensory papillae arranged in a single row along most sensory canals, and, although difficult to discern, on snout and top of head.

The general appearance of *E. cryomargarites* is shown in Figs. 1 and 3. The body is flaccid, overall color in ethanol is tan with relatively uniform distribution of small melanophores, more concentrated along myosepta and bases of vertical fins; tongue ranging from pale cream colored to black; skin lining mouth and branchial cavity ranging from tan with scattered melanophores to uniform brown (dense melanophores); outer surface of stomach black; outer surface of intestine usually black, sometimes tan; peritoneum tan with scattered melanophores.

Posterior portion of maxillary unsheathed (Figs. 1 and 3); each premaxillary and dentary with 1–2 large canines anteriorly; teeth on premaxillaries conical, depressible, and pluriserial, tapering to one row anteriorly at the base of the canines and to two rows of shorter teeth posteriorly; dentary teeth pluriserial with innermost row fixed and outer row depressible; dentary not noticeably narrowed between anterior canines and band of conical teeth; palatines with two irregular rows of blunt conical teeth; vomer with an irregular row of small, conical teeth laterally flanking a median row of 1–5 slightly larger conical teeth; three small

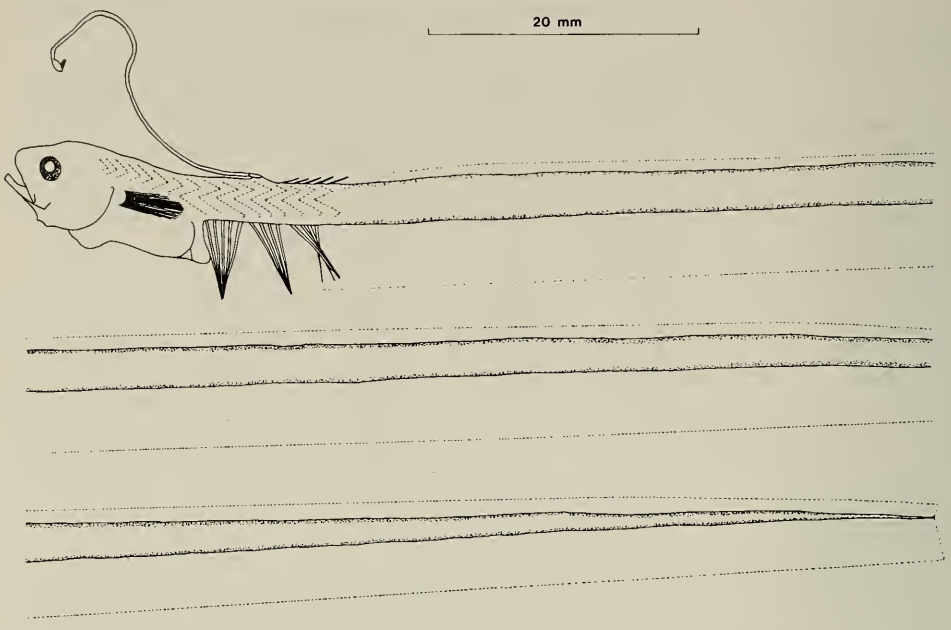

Fig. 5. *Echiodon cryomargarites* larva, LACM 42592-1. Dotted lines represent continuation of dorsal and anal fins. Stippling on body used to highlight contours and myosepta and does not represent pigmentation.

tooth patches on or associated with pharyngobranchials 2, 3 and 4; fifth ceratobranchial with medial row of small, conical teeth.

Lateral line difficult to follow, apparently restricted to anterior one third of body.

Limited osteological observations were made on three specimens cleared and counter stained for cartilage and bone (ISH 1108/66, ISH 1818/68, LACM 10985-7 and LACM 10984-3). Otoliths (sagittae) reduced relative to other carapids, their lengths about 10–15% of cranial vault length. Transverse processes of first three vertebrae with typical carapine modifications (Regan 1912; Courtenay and McKittrick 1970; Olney and Markle 1979). First two processes moveable, third and subsequent rigid (Fig. 4A). Distal tips of first two processes ligamentously attached to paired sclerified structures at anterior end of swimbladder (Fig. 4A and B). Sclerified structures stain lightly with Alcian Blue and lie anteriad of a constriction in swimbladder (Fig. 4B). (This condition may represent a precursor of the rocker bone in *Onuxodon.* If so, the rocker bone may be an ossified anterior chamber of a swimbladder that was derived from the main swimbladder.) Third process expanded, curving inward, with its posterior surface attached to the swimbladder behind the constriction (Fig. 4). Swimbladder tapers slightly posteriad and ends under vertebrae 15–16. Large tenth cranial nerve (Vagus) passes along vertebral column, under first two transverse processes and above remainder.

Etymology.—A combination of the Greek "kryos" meaning cold and "margarites," a pearl, in reference to the Antarctic distribution of this new pearlfish.

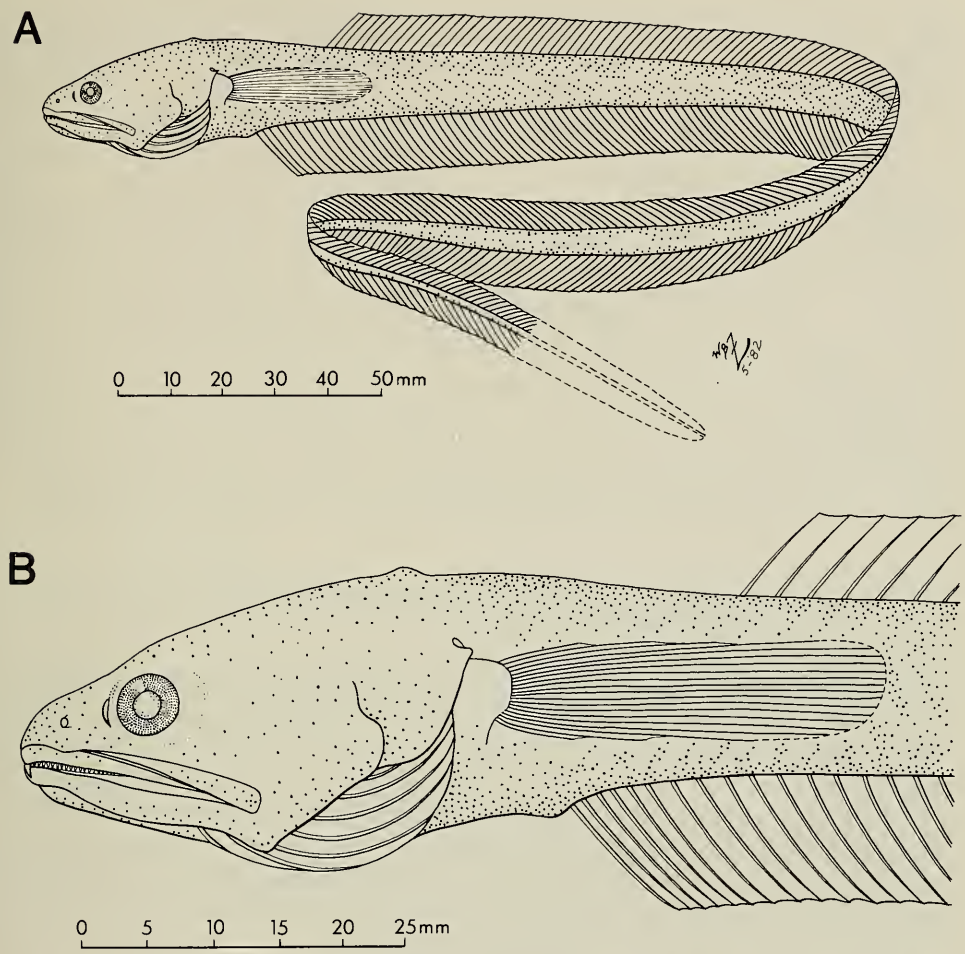

Fig. 6. *Echiodon* specimen, LACM 42593-1, 30.8 mm HL. A, Left lateral view; B, Close up of head. Prepared by W. Zomlefer.

Echiodon cryomargarites—Larvae

Material Examined.—Off New Zealand: ZMUC Dana 3641[1], 77 mm TL, 4.6 mm HL, 43°40′S, 176°36′E, 8 Jan 1929, stramin net, 300 m wire out. USNM 257747, ca. 67 mm TL, 4.4 mm HL; 43°00′S, 173°57′24″E, 7 Mar 1974, 1 m net. LACM 11505, 63+ mm TL, 3.6 mm HL; "*Eltanin*" sta 2217, 51°29.0′S, 160°13.0′E, 20 Jun 1968, IKMT. ZMUC P7710, 190 mm TL, 7.0 mm HL; ca. 42°S, 174°E, 10 Dec 1914, collected by Campbell Island shepherds on shore of Perserverance Harbor, Antarctic Convergence, mid-Pacific: LACM 42592.1, ca. 205 mm TL, 7.9 mm HL; "*Eltanin*" sta 16, 49°06-10′S, 120°13-15′W, 19 Dec 1965, IKMT, 0–200 m.

Comments.—Larvae were identified as belonging to this species on the basis of their unique combination of meristic characters (A_{30}, D_{30}, precaudal vertebrae,

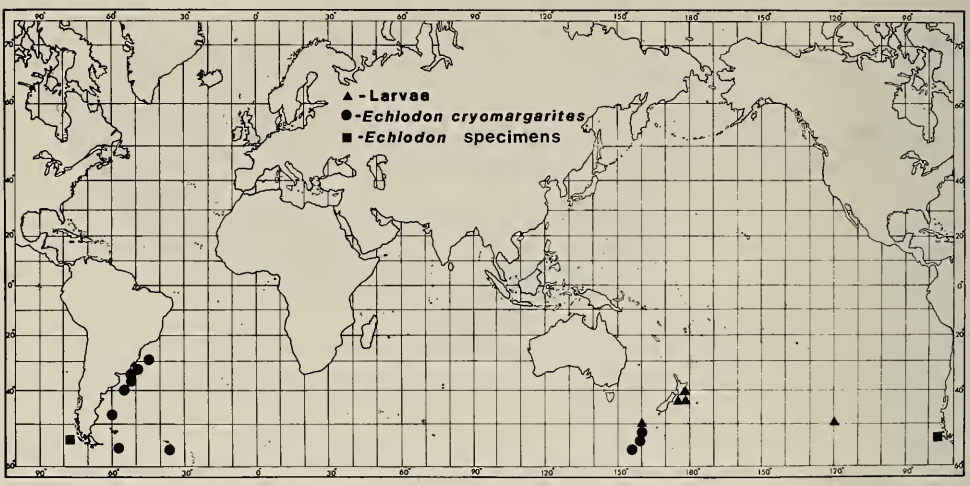

Fig. 7. Chart showing distribution of adults and larvae of *E. cryomargarites* and *E.* specimens.

and fin positions), distributional data, and gross similarity to larvae of *E. drummondii* and *E. dentatus* (Maul 1976, personal observation). Selected measurements and counts are shown in Table 2.

The general appearance of the largest larva is illustrated in Fig. 5. Noteworthy features are the sac-like drooping gut (Rendahl 1926) to which the first anal fin ray is attached, the relatively long anal fin rays, and the absence of pigment. In the three smallest specimens, 3.6–4.6 mm HL, about ten internal pigment spots were present along the vertebral column. These commence at centra 13 or 14 and are spaced about 7 to 12 centra apart. These were difficult to see even in the smallest specimen due to occlusion by epaxial musculature but were readily apparent in the 4.4 and 4.6 mm specimens after trypsin digestion.

Echiodon Specimens
Figs. 1C and D

Material Examined.—LACM 42593-1, 335 mm TL, 30.8 HL, female; "*Eltanin*" sta 21, 53°13′–16′S, 75°41′W, 5 Jan 1966, 1.5 m Blake trawl, 1500–1666 m. LACM 42593-2, 300 mm TL, 25.6 mm HL, female; same data as LACM 42593-1.

Comments.—These two specimens differed slightly in geographic distribution and morphology from *E. cryomargarites.* They have a firm body, D_{30} 35 and were caught at depths of 1500–1666 m. The general appearance of these specimens is shown in Fig. 6. Coloration, dentition, and otoliths are as for *E. cryomargarites.* The lateral line is difficult to follow but apparently extends over two thirds of the body length. Morphometric data are summarized in Table 1. Meristic data are as follows: D_{30} 35, A_{30} 46–48, pectoral fin rays on left side 20–21, anal fin origin under vertebrae 6–8, dorsal fin origin over vertebra 12, precaudal vertebrae 27–29, developed gill rakers 3, olfactory rosette with seven pairs of lamellae.

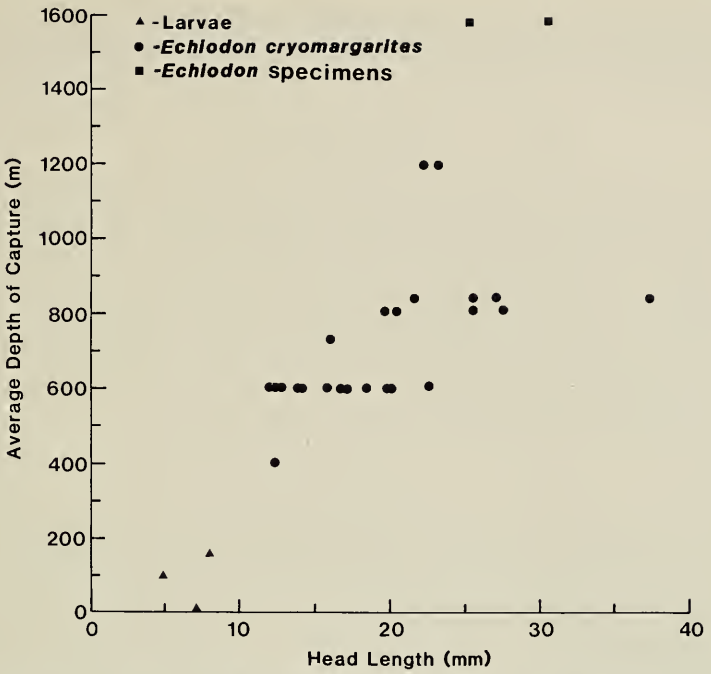

Fig. 8. Relationship between average depth of capture and size (head length) of *E. cryomargarites* adults and larvae and *E.* specimens.

These specimens described above closely resemble and may be conspecific with *E. cryomargarites.* Both forms are distinguished from *E. exsilium* and *E. dawsoni,* which have fewer precaudal vertebrae (21–24) and from *E. dentatus* and *E. drummondii,* which have slightly higher D_{30} (42–45), fewer pectoral fin rays (15–17), and fewer vertebrae to the dorsal fin origin (8–9).

Distribution

The geographic distribution of *E. cryomargarites* is shown in Fig. 7. The well established dispersal capabilities of the larvae (Olney and Markle 1979) and the West Wind Drift are sufficient to account for the wide geographic range of the species. *Antimora rostrata, Halargyreus johnsonii,* and *Merluccius australis* have similar distribution patterns (Iwamoto 1975; Cohen 1973; Inada 1981). The first two of these species co-occurred with *E. cryomargarites* in four of eleven (36%) of our adult collections (M. Stehmann, personal communication, 5 Jan 1982; LACM catalog records). In at least one case, *M. australis,* geographic variants had been described as different species but are now recognized as synonyms (Inada 1981).

There was no evidence of commensalism, and the species appear to be free living.

With one exception (ISH 300/71) all adults were caught in bottom trawls fished on continental or insular slopes. There appears to be ontogenetic descent in *E.*

cryomargarites with larger specimens being found deeper (Fig. 8). The two *Echiodon* specimens were found at about twice the depth of similar-sized *E. cryomargarites* (Fig. 8).

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(DFM) The Huntsman Marine Laboratory, St. Andrews, New Brunswick, Canada EOG 2X0; (JTW) Florida State Museum and Department of Zoology, Uni-

versity of Florida, Gainesville, Florida 32611; present address: Division of Fishes, NHB WG-12, Smithsonian Institution, Washington, D.C. 20560; (JEO) Virginia Institute of Marine Science and the College of William and Mary, Gloucester Point, Virginia 23062.